

REMARKS

Claims 1-34 and 36 are pending.

1. Rejection of Claims 1-4, 6-14, 31, and 32 under 35 U.S.C. §103(a)

Claims 1-4, 6-14, 31 and 32 stand rejected under 35 U.S.C. §103(a) over WO 99/50886 ("Schoepp") in view of U.S. Patent No. 6,267,121 ("Huang"). The reasons for the rejection are stated at pages 2-4 of the Official Action. The rejection is respectfully traversed.

Claim 1 recites a method of processing semiconductor substrates and reducing particle contamination during processing of the substrates. The method comprises *inter alia* "(a) installing at least one ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface in an interior space of a vacuum processing chamber so that the surface is exposed to the interior space"; "(b) after step (a), treating the exposed surface to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment"; "(c) after step (b), processing at least one production wafer by supplying process gas to the processing chamber" (Emphasis added.) Schoepp and Huang fail to disclose or suggest the method recited in Claim 1 for the following reasons.

Applicant determined that if a ceramic part including a machined and/or sintered surface having attached particles of ceramic material is present in a plasma processing chamber *at the same time that production wafers are processed in the chamber*, large numbers of the particles can be dislodged from the surface and contaminate the production wafers. The method recited in Claim 1 provides a solution to this problem. According to

the recited method, at least one ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface is installed in an interior space of a vacuum processing chamber; *then* the part is treated by a high intensity plasma conditioning treatment, which reduces (removes) attached particles of *the non-oxide ceramic material* from the surface; and *then* at least one production wafer is processed in the processing chamber. That is, the production wafer is not processed until *after* the attached particles have been removed from the surface of the part. Consequently, the attached particles that were previously removed from the surface by the conditioning treatment *cannot* be a source of particle contamination during the later processing of the production wafer(s) in the processing chamber.

The Official Action asserts that Schoepp discloses "treating a SiC surface and reducing particle contamination by supplying process gas to the processing chamber ... and energizing the process gas into a plasma that comprises high density plasma" Applicant respectfully disagrees with these assertions.

Schoepp discloses using silicon carbide as a material for one or more reactor surfaces to reduce metal and/or particle contamination of plasma-processed substrates by reducing plasma potential on the silicon carbide member and/or by reduced sputtering of non-silicon carbide chamber interior surfaces. Schoepp discloses that metal and/or particle contamination is reduced by use of silicon carbide, but does not suggest removing particles of non-oxide ceramic material from the silicon carbide member. To the contrary, Schoepp discloses reduced sputtering of non-silicon carbide chamber interior surfaces.

Huang fails to cure the deficiencies of Schoepp. Particularly, Huang discloses a seasoning process for a plasma etching chamber. Huang discloses that byproduct material resulting from the etching process, typically from etching about 100 wafers, builds up on the interior walls of the chamber and eventually becomes thick enough to start peeling and contaminate the product (col. 3, lines 16-23). To avoid the walls becoming too heavily coated, they are dry cleaned on a routine schedule (col. 3, lines 24-31). Huang discloses that once dry cleaning has been satisfactorily completed, it is necessary to "season" the unit, which involves the redeposition of sufficient etch product on the chamber walls to return the electrical characteristics of the chamber to that which normally prevails during plasma processing (col. 3, lines 32-37).

Huang's disclosed seasoning process is unrelated to the process recited in Claim 1. Huang fails to disclose or suggest treating a machined and/or sintered surface *of a ceramic part made of a non-oxide ceramic material* by a high intensity plasma processing treatment *before processing production wafers in a processing chamber containing the ceramic part* to remove attached particles of *the non-oxide ceramic material* on the surface. Rather, Huang discloses performing dry cleaning the interior walls on a routine schedule to remove etching byproduct from them. Huang does not disclose that the interior walls are of a ceramic material. Thus, Huang also does not disclose or suggest that the interior walls have a machined and/or sintered surface with particles of a non-oxide ceramic material attached to the surface. Huang further does not disclose or suggest removing attached particles from the interior walls by a high intensity plasma processing treatment *before* production wafers are etched in the chamber. Accordingly, Huang provides no suggestion

or motivation to modify Schoepp to achieve the method recited in Claim 1. Thus, the Official Action has not established a *prima facie* case of obviousness. *See*, MPEP §2143.

Claims 2-4, 6-13, 31, and 32 depend from Claim 1 and, thus, also are patentable over Schoepp and Huang for at least the same reasons that Claim 1 is patentable.

Claim 14 recites a method of processing semiconductor substrates and reducing particle contamination during processing of the substrates, which comprises *inter alia* "(a) placing at least one production wafer on a substrate holder in an interior space of a vacuum processing chamber, the processing chamber comprising a plasma reactor and including at least one ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface exposed to the interior space, *the exposed surface having been treated to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment (i) after the part having been installed in the processing chamber and (ii) before processing production wafers in the processing chamber with the part installed in the processing chamber*, the conditioning treatment comprising treating the exposed surface with a high density plasma while seasoning the processing chamber" (Emphasis added.) Schoepp and Huang fail to disclose or suggest the method recited in Claim 14 for the following reasons.

As explained above, neither Schoepp nor Huang discloses or suggests treating an exposed surface of a ceramic part having particles of non-oxide ceramic material attached thereto by a high intensity plasma conditioning treatment "*(i) after the part having been installed in the processing chamber and (ii) before processing production wafers in the processing chamber with the part installed in the processing chamber,*" as recited in Claim

14. As explained above, Huang performs the dry cleaning step to remove etch byproducts from interior walls. There is no suggestion in Huang to remove attached particles of the material of the interior walls. Accordingly, the method recited in Claim 14 also is patentable over Schoepp and Huang.

Therefore, withdrawal of the rejection is respectfully requested.

2. Rejection of Claim 5 under 35 U.S.C. §103(a)

Claim 5 stands rejected under 35 U.S.C. §103(a) over Schoepp in view of Huang and further in view of U.S. Patent No. 5,863,376 ("Wicker"). The reasons for the rejection are stated at pages 4-5 of the Official Action. The rejection is respectfully traversed.

The Official Action asserts that Wicker discloses a sequential method of processing wafers in a chamber. However, Wicker fails to cure the above-described deficiencies of Schoepp and Huang regarding the method recited in Claim 1, from which Claim 5 depends. Accordingly, the method recited in Claim 5 also is patentable for at least the same reasons that Claim 1 is patentable.

Therefore, withdrawal of the rejection is respectfully requested.

3. Rejection of Claims 15-28, 30, 33, and 34 under 35 U.S.C. §103(a)

Claims 15-28, 30, 33, and 34 stand rejected under 35 U.S.C. §103(a) over Schoepp. The reasons for the rejection are stated at pages 5-6 of the Official Action. The rejection is respectfully traversed.

Claim 15 recites a method of plasma conditioning a machined and/or sintered surface of a ceramic part of a semiconductor processing chamber, which comprises

"treating the surface to reduce particles of the ceramic material attached to the surface by contacting the surface with a high intensity plasma *before processing production wafers in the processing chamber with the ceramic part being present in the processing chamber*" (emphasis added). For reasons stated above, Schoepp fails to disclose or suggest the method recited in Claim 15, which is thus patentable over Schoepp.

Claims 16-28, 30, 33, and 34 depend from Claim 15 and, accordingly, also are patentable over Schoepp for at least the same reasons that the subject matter recited in Claim 15 is patentable over Schoepp.

Therefore, withdrawal of the rejection is respectfully requested.

4. Rejection of Claims 29 and 36 under 35 U.S.C. §103(a)

Claims 29 and 36 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Schoepp in view of Huang. The reasons for the rejection are stated at pages 6-7 of the Official Action. The rejection is respectfully traversed.

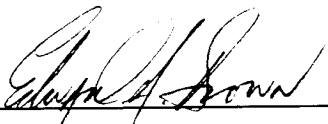
Claims 29 and 36 depend from Claim 15. Huang fails to cure the above-described deficiencies of Schoepp regarding Claim 15. Accordingly, Claims 29 and 36 also are patentable for at least the same reasons that the subject matter recited in Claim 15 is patentable. Therefore, withdrawal of the rejection is respectfully requested.

For the foregoing reasons, withdrawal of the rejections and prompt allowance of the application are respectfully requested.

Respectfully submitted,

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